2013 Maryland FMP Report (July 2014)
Section 1. American Eel ((*Anguilla rostrata)*

Currently, the American eel stock is considered depleted.[1] The stock depletion is the result of fishing pressure coupled with habitat loss especially due to fish blockages, water quality, possible increase in natural mortality due to parasite infection, and climate change impacts on water currents along the Atlantic coast. The eel's unique life history strategy complicates successful management. American eel are catadromous. They spawn in the Sargasso Sea (east of the Bahamas and south of Bermuda) and their larvae (leptocephalii) are carried by currents along from South America to Greenland. Leptocephalii metamorphose into glass eels that migrate into estuaries. When glass eels become pigmented, they are referred to as elvers which either remain in estuaries or migrate into freshwater portions of rivers and streams. There, elvers continue to grow into larger, immature yellow eels. Maturation of American eel differs by sex: 12-16" for males and >16" for females. Mature silver eels then migrate back to the Sargasso Sea to spawn. Silver eels can range in age from 3 to 30 years, largely dependent upon sex and latitude. The broad range of habitats utilized and complex life history make American eel difficult to assess and manage.

A Chesapeake Bay American Eel Fishery Management Plan (CBFMP) was adopted in 1991. The CBFMP goal is to manage the American eel population in the Chesapeake Bay and its tributaries so that harvest does not exceed the natural capacity of the population to maintain its size from year to year. The CBFMP was reviewed in 2014. The Plan Review Team concluded that the CBFMP management framework is still appropriate for managing the population in Chesapeake and Coastal bays but recommended the development of an amendment to adopt the ASMFC guidelines and any management strategies from Addendum IV.

The ASMFC adopted a coastal FMP for American Eel in 1999. The goal is to conserve and protect the American eel resource to ensure its continued role in the ecosystem while providing the opportunity for its commercial, recreational, scientific, and educational use. The ASMFC developed the FMP to address data needs and other information which indicated the decline of some segments of the American eel population. Jurisdictions were required to implement fishery-independent young-of-the-year (YOY) monitoring surveys.

Addendum I (2006) to ASMFC's FMP required implementation of a commercial licensing and reporting system for American eel fisheries in order to collect catch and effort data. Addendum II (2008) recommended stronger regulatory language by state and federal agencies, such as the Federal Energy Regulatory Commission, to improve upstream and downstream passage at dams, particularly for emigrating silver eels. The ASMFC implemented Addendum III (2012) to reduce mortality of glass (Maine and South Carolina only), yellow, and silver eels. Management requirements included commercial minimum size, gear restrictions, seasonal closure, and recreational size and creel limits. Addendum IV (2014) was developed to reduce overall mortality among glass, yellow, and silver eel. Management measures to reduce mortality will be adopted in 2015. Each jurisdiction is required to complete an ASMFC annual compliance report.

Stock Status

The 2012 ASMFC benchmark American eel stock assessment concluded that the American eel stock was depleted.[1] Stock depletion is "likely due to a combination of fishing pressure, habitat loss due to damming mainstems and tributaries of rivers, mortality from passing through hydroelectric turbines, pollution, possibly parasites and disease, and unexplained factors at sea." [1] Climate change has the potential to alter ocean circulation patterns, however, the ramification of such a change is unknown. Although the American eel stock was declared depleted, biomass and fishing mortality reference points could not be determined with confidence.[1] The Stock Assessment Peer Review Panel recommended waiting at least five years before conducting the next stock assessment [1] which is scheduled for 2017.[2] Coastal states will continue monitoring and data collection programs.

Current Management Measures

Glass eel and elver fisheries are prohibited in Maryland.[1] Beginning in 2014, the commercial and recreational minimum size limit will be increased from 6" to 9" in Maryland, including the Potomac River. There is no harvest limit for the commercial fishery but beginning January 1, 2014, there will be a seasonal closure on harvest from September 1st to December 31st. The recreational creel is 25 eels per person per day. Both fisheries were open all year in 2013. Eel pots are to have a minimum mesh size of ½" x ½", however eel pots may have smaller mesh sizes provided they have escape panels. States have up to 3 years starting January 1, 2014 to implement the ½" x ½" mesh size for all pots and totally eliminate the use of small mesh size.

Maryland conducts both fishery dependent and independent annual surveys. Landings from the commercial eel pot fishery are monitored. Fishery independent monitoring includes a yellow eel pot survey in the Sassafras River, a silver eel trap survey in a first order stream of the Corsica River, and young-of-the-year abundance in the coastal bays [3]. Yellow and silver eel are subsampled for ageing and the prevalence of the swimbladder parasite *Anquillicolla crassus.* [3]

The Maryland Department of Natural Resources' Fish Passage Program added eels to its list of targeted species. Blockage removal projects consider whether or not eels would benefit from implementing a proposed project. The ASMFC published the Proceedings of a Workshop on American Eel Passage Technologies (July 2013). The workshop participants agreed that traditional fish passage structures (fishways and fish lifts) are ineffective at passing juvenile eels and that specialized eel passage structures are necessary.

The Fishery

Ninety-nine percent of commercially harvested American eel were caught using eel pots [3]. Maryland's commercial fishery landed 643,000 pounds of American eel during 2012 [4] (Figure 1) and preliminary landings for 2013 are 568,199 lbs. Harvest has decreased since the record high of 918,000 pounds in 2010 (Figure 1). Commercial crabbers are allowed to harvest American eel for use as trotline bait. The 2013 reported harvest was 29,800 pounds. The 18 year average eel harvest from 2004-2012 was 25,400 pounds. Eel landings reported on crab harvester forms are not included in National Marine Fisheries Service commercial landings data.[3]

Recreational harvest data for American eel is not available from the Marine Recreational Information Program.[4] Because of the data deficiency, recreational harvest of eel is considered to be negligible.

Issues/Concerns

Draft Addendum IV to the ASMFC's American eel FMP was released for public review in June, 2014. Maryland Department of Natural Resources held a public hearing on July 2nd, 2014. Draft Addendum IV focuses on options for management of commercial glass (including aquaculture), yellow, and silver eel fisheries.[5] It also includes provisions whereby states may, with ASMFC Management Board approval, implement a state specific sustainable fishery management plan.[5].For the current status of Amendment IV, go to http://www.asmfc.org/species/american-eel.

The U.S. Fish and Wildlife Service (USFWS) is required to publish a review of American eel status by September 30, 2015.[6] The review is in response to a 2010 petition filed by the Center for Environmental Science, Accuracy, and Reliability (formerly Council for Endangered Species Reliability) for listing as threatened under the Endangered Species Act and a later lawsuit filed in 2012.[6] A previous review by USFWS in 2007 determined that protection under the Endangered Species Act was not warranted.[6,7]

The only legal glass eel fisheries along the Atlantic Coast are in the states of Maine and South Carolina.[1] Glass eels are primarily exported to Asian markets. As of 2012, the price per pound for glass eels exceeded $2,000.[1] The estimated value of the coastal glass eel fishery was $40 million (2012). The high market price makes them susceptible to poaching.

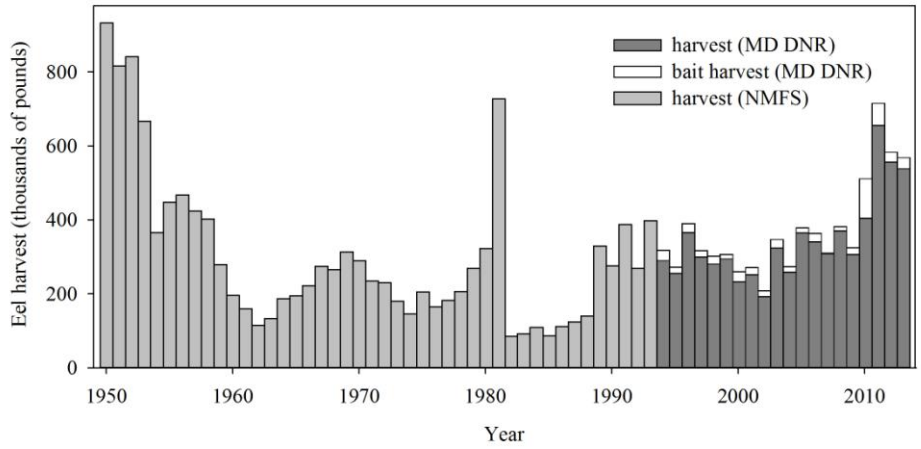
Stream and river blockages reduce American eel access to significant amounts of historic habitat. The Maryland Department of Natural Resources' Fish Passage Program priority projects provide passage for diadromous species which includes American eel.[8] The ASMFC published the Proceedings of a Workshop on American Eel Passage Technologies [9] whereby the workshop participants determined that traditional fish passage structures (fishways and fish lifts) are ineffective at passing juvenile eels and that specialized eel passage structures are necessary. Downstream movement of yellow and silver eels is particularly problematic at hydropower structures where mortality can be as high as 100%.

American eel provide a unique ecosystem service as they are a primary host for freshwater mussel larvae and are the primary means of mussel dispersal within a river/stream. Mussels provide important ecological services as water filters in freshwater. Providing fish passage so American eels have the opportunity to move into freshwater habitat will facilitate the rebuilding of freshwater mussel populations.

Climate change has been implicated as a causative agent to alteration of leptocephali prey availability and temperature and circulation changes within the Sargasso Sea. [10,11,12] Such changes have the potential to reduce survival and successful transport to estuarine habitats.

American eel are susceptible to the swim bladder parasite *Anguillicoloides crassus*. Average prevalence rate among Chesapeake Bay eels was 50% from 2004-2012.[3] The effect of the parasite on yellow and silver eel stages is not known.

Figure 1. American eel commercial landings in Maryland, 1950-2013. Data for the years 1950-1993 obtained from the National Marine Fisheries Service [4]. Data for years 1994-2013 was provided by Keith Whiteford, Maryland Department of Natural Resources (personal communication).



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[8] Prioritization Criteria for Fish Passage Projects in Maryland http://dnr2.maryland.gov/fisheries/Documents/ProjectCriteriaandGoal.pdf

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1991 Chesapeake Bay American Eel Management Plan Implementation Table (updated 08/14)			
Strategy	**Action**	**Date**	**Comments**
1.1 The jurisdictions will adopt a conservative management approach until stock assessment analyses have been completed for American eels in the Bay.	1.1A) Maryland and the Potomac River Fisheries Commission will adopt a minimum size limit of 6 inches for American eels in the Bay. B) Virginia will continue its prohibition on the taking of elvers and will adjust its definition to correspond to a 6" minimum size limit.	1992 1993 Continue 2005/2006 2012 2013 **2014** **2017**	Glass eel and elver fisheries are prohibited. No commercial harvest limit. Commercial season open all year for pots and traps. VA restricts other gear to January 1 to August 31. MD, PRFC, VA recreational limit is 25 eels/person/day. Limit for charter/head boat captain or crew is 50 eels/day. There are no harvest regulations in District of Columbia and PA. A coastal stock assessment was conducted in 2005 but the peer review panel determined that the terms of reference were either partially or insufficiently met. A benchmark coastal stock assessment was completed in 2012 and concluded that eels are depleted along the coast. Addendum III to the Interstate Eel FMP required an increase in minimum size from 6" to 9" for all fisheries. Starting in 2014 harvest of eels will be prohibited from 9/1-12/31 by any gear other than a baited eel pot or spear. i.e no harvest of eels with fyke or pound nets. **Draft Addendum IV was released for public comment during summer 2014. ASMFC Management Board is continuing to evaluate management options which may result in new measures in 2015.** **A stock assessment is scheduled for 2017.**
	1.2A) Maryland will implement a ½ x ½" minimum mesh size for eel pots. B) Virginia and the Potomac River Fisheries Commission will continue to enforce a ½ x ½" minimum mesh size for eel pots. Virginia will continue to enforce the escape panel requirements in ½ x ½" mesh pots.	1993 Continue 2013	MD, VA and PRFC currently enforce the ½" x ½" minimum mesh size for eel pots**.** Eel pots in MD with undersize mesh require a 16 in^2 escape panel of ½" x ½" mesh. In MD, pots with mesh size <½" require escape panels. Addendum III to the Interstate Eel FMP requires that by January 1, 2017 the entire pot must be ½" x ½" mesh. Escape panels will no longer be allowed in small mesh pots (< ½" mesh). Virginia ½" x 1" escape panels in ½" x ½" mesh pots.
	1.3 Upon restoration of American eels to the Susquehanna River basin, the Pennsylvania Fish Commission (PFC) will adopt regulations to prevent the overharvest of small eels.	On-going 2010 2013	CBP fish passage goal of 2,807 miles opened by 2014 is 92% complete The 2010 SRAFRC restoration plan did not have specific restoration goals for eel. Addendum III (2013) to the plan specifies eel restoration goals http://www.srbc.net/pubinfo/docs/SRAFRC_American_Eel_Restoration_Plan_20140527_220124v1.pdf

1991 Chesapeake Bay American Eel Management Plan Implementation Table (updated 08/14)			
Strategy	**Action**	**Date**	**Comments**
			There are no harvest regulations in PA.
2.1 Catch and effort statistics for the American eel crab bait fishery will be obtained.	2.1 Maryland will require the reporting of American eels used for the crab bait fishery on their mandatory finfish reporting forms.	1993 2007 Continue	Information gathered from the Crab Reporting Forms indicated that previous bait estimates were probably too high. ASMFC required coastal states/jurisdictions to collect eel catch and effort data from all eel fisheries. MD commercial crabbers are required to report their harvest and effort of eels used for bait. These forms were changed in 2010 and may have increased reporting. Commercial crabbers can use up to 50 eel pots with no catch limit.
3.1 The jurisdictions will increase their understanding of the American eel resource in the Chesapeake Bay. Important research topics include but are not limited to the following: fishery independent estimates of abundance; mortality rates; the effects of fishing exploitation on growth; the factors that influence recruitment in the Bay; and how economic aspects affect the eel fishery.	3.1A) Maryland and Virginia will continue to collect catch and effort data from the live-eel fishery and begin monitoring the bait eel fishery. B) PRFC will continue to collect catch and effort data from their commercial fishery.	1997 2000 2006 Continue	MD conducts an annual population study. ASMFC implemented mandatory commercial reporting by life stage. ASMFC adopted Addendum I to the Coastal Eel FMP to improve data collection and subsequent stock assessments.
	3.2 Maryland, the Potomac River Fisheries Commission, and Virginia will encourage research to collect basic biological and socioeconomic information.	Continue 2000 2007 2010 On-going 2006	The ASMFC coastal eel FMP required states/jurisdictions to conduct an annual young of year survey. USFWS determined there was no need to list eels as endangered or threatened. USFWS was petitioned a second time for an eel status review. **The published status review of the second petition is due in September, 2015.** MD initiated an annual fishery independent eel pot survey and silver eel survey. Eel are also sampled for disease (swimbladder parasite *Anquillicolla crassus*) prevalence. CB long term average (2004-2012) was 50%.
4.1 The District of Columbia, Environmental Protection Agency, Maryland, Pennsylvania, the Potomac River Fisheries Commission, and Virginia will continue to promote the commitments of the 1987 Chesapeake Bay Agreement. The achievement of the Bay commitments will lead to improved water quality and enhanced biological production. In addition, the jurisdictions have committed to providing	4.1 The jurisdictions will continue to provide for fish passage at dams, and to remove stream blockages wherever necessary.	2005 2009 On-going **2014** 2008	CBP fish passage goal was to open an additional 1,000 miles of tributary from 2005 to 2014. Another goal was to open 2,807 miles by 2014. **This goal is 92% complete. The 2014 CB Watershed Agreement (prompted by Executive Order 13508) included an outcome for opening 1,000 miles of migratory fish passage by 2025 (baseline mileage 2,041). American eel was identified as one of the focal species.** ASMFC approved Addendum II to the Coastal eel FMP which placed an emphasis on improving upstream and downstream passage. USFWS conducted a study to determine the timing & cues for out-migrating eels in the Shenandoah River. Results of the study indicate that outmigration is variable and sometimes protracted.[13]

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upstream passage for migratory fishes.		2012	Study of the Embry Dam removal on the Rappahannock River indicated that the restoration resulted in increased numbers of eels as far as 100 miles upstream.[14]
	4.2 The jurisdictions will continue to set specific objectives for water quality goals and review management programs established under the 1987 Chesapeake Bay Agreement. The Agreement and documents developed pursuant to the Agreement call for: A) Developing habitat requirements and water quality goals for various finfish species. B) Developing and adopting basinwide nutrient reduction strategies. C) Developing and adopting basinwide plans for the reduction and control of toxic substances. D) Developing and adopting basinwide management measures for conventional pollutants entering the Bay from point and nonpoint sources. E) Quantifying the impacts and identifying the sources of atmospheric inputs on the Bay system. F) Developing management strategies to protect and restore wetlands and submerged aquatic vegetation. G) Managing population growth to minimize adverse impacts to the Bay environment.	Continue 2005 2009 On-going **2014**	Chesapeake Bay Program develops, revises, and monitors goals and strategies for restoration. The 2014 CBP Watershed Agreement revised the goals and outcomes. For more information: http://www.chesapeakebay.net/issues/issue/menhaden http://www.chesapeakebay.net/issues/issue/shad http://www.chesapeakebay.net/issues/issue/striped_bass http://www.chesapeakebay.net/issues/issue/nutrients http://www.chesapeakebay.net/issues/issue/chemical_contaminants http://www.chesapeakebay.net/issues/issue/wastewater http://www.chesapeakebay.net/issues/issue/agriculture http://www.chesapeakebay.net/issues/issue/sediment http://www.chesapeakebay.net/issues/issue/stormwater_runoff http://www.chesapeakebay.net/issues/issue/development http://www.chesapeakebay.net/issues/issue/air_pollution http://www.chesapeakebay.net/issues/issue/wetlands http://www.chesapeakebay.net/issues/issue/bay_grasses CBP fish passage goal was to open an additional 1,000 miles of tributary from 2005 to 2014. Another goal was to open 2,807 miles by 2014. **This goal is 92% complete. The 2014 CB Watershed Agreement (prompted by Executive Order 13508) included an outcome for opening 1,000 miles of migratory fish passage by 2025 (baseline mileage 2,041). American eel was identified as one of the focal species.**

ASMFC – Atlantic States Marine Fisheries Commission
CB – Chesapeake Bay
CBP – Chesapeake Bay Program
FMP – Fishery Management Plan
PFC – Pennsylvania Fish Commission
PRFC – Potomac River Fisheries Commission
SRAFRC – Susquehanna River Anadromous Fish Restoration Cooperative
USFWS – United States Fish & Wildlife Service